

BepiColombo's best images yet highlight fourth Mercury flyby

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BepiColombo's closest approach to Mercury. Credit: European Space Agency

The ESA/JAXA BepiColombo mission has successfully completed its fourth of six gravity assist flybys at Mercury, capturing images of two special impact craters as it uses the little planet's gravity to steer itself on course to enter orbit around Mercury in November 2026.

The [closest approach](#) took place at 23:48 CEST (21:48 UTC) on 4 September 2024, with BepiColombo coming down to around 165 km above the planet's surface. For the first time, the spacecraft had a clear view of Mercury's south pole.

"The main aim of the flyby was to reduce BepiColombo's speed relative to the sun, so that the spacecraft has an [orbital period](#) around the sun of 88 days, very close to the orbital period of Mercury," says Frank Budnik, BepiColombo Flight Dynamics Manager.

"In this regard it was a huge success, and we are right where we wanted to be at this moment. But it also gave us the chance to take photos and carry out science measurements, from locations and perspectives that we will never reach once we are in orbit."

Images from BepiColombo's three monitoring cameras have arrived back on Earth, providing a unique view of Mercury's surface from three different angles. BepiColombo approached Mercury from the 'nightside' of the planet, with Mercury's cratered surface becoming increasingly lit up by the sun as the spacecraft flew by.

M-CAM 2 provided the best views of the planet during this flyby, capturing more and more of the planet as BepiColombo came round to the side of Mercury lit by the sun. M-CAM 3 also chipped in a stunning

image of a newly named impact crater.

M-CAMs 2 and 3 are now switched off, but M-CAM 1 will continue imaging Mercury until about midnight tonight (24 hours after closest approach), getting a beautiful view of the planet receding into the distance.

Mercury lays bare its Four Seasons

Four minutes after closest approach, a large 'peak ring basin' came into BepiColombo's view. These mysterious craters—created by powerful asteroid or comet impacts and measuring about 130–330 km across—are called peak rings basins after the inner ring of peaks on an otherwise flattish floor.

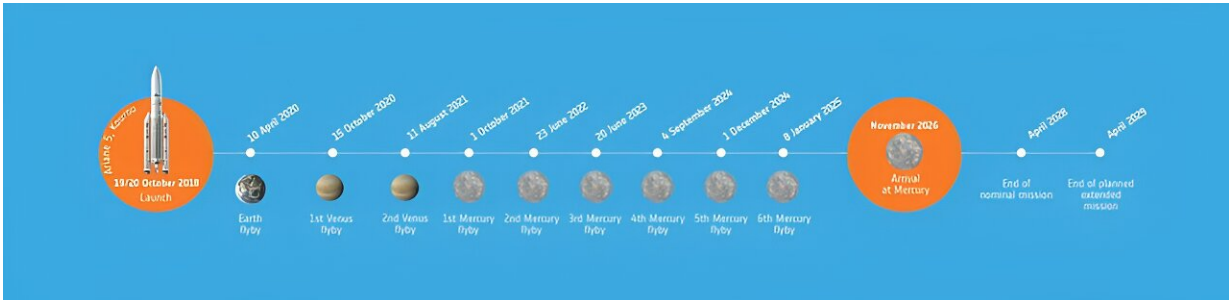
This large crater is Vivaldi, after the famous Italian composer Antonio Vivaldi (1678–1741). It measures 210 km across, and because BepiColombo saw it so close to the sunrise line, its landscape is beautifully emphasized by shadow. There is a visible gap in the ring of peaks, where more recent lava flows have entered and flooded the crater.

First sight of crater newly named after New Zealand artist

Just a couple of minutes later, another special peak ring basin came into view. This one measures 155 km across.

"When we were planning for this flyby, we saw that this crater would be visible and decided it would be worth naming due to its potential interest for BepiColombo scientists in the future," explains David Rothery, Professor of Planetary Geosciences at the UK's Open University and a member of the BepiColombo M-CAM imaging team.

Following a request from the M-CAM team, the ancient crater was recently assigned the name Stoddart by the International Astronomical Union's Working Group for Planetary System Nomenclature after Margaret Olrog Stoddart (1865–1934), an artist from New Zealand known for her flower paintings.



BepiColombo timeline. Credit: European Space Agency

"Mercury's peak ring basins are fascinating because many aspects of how they formed are currently still a mystery. The rings of peaks are presumed to have resulted from some kind of rebound process during the impact, but the depths from which they were uplifted are still unclear," continues David.

Many of Mercury's peak ring basins have been flooded by volcanic lava flows long after the original impact. This has happened inside both Vivaldi and Stoddart. Inside Stoddart, the trace of a 16-km-wide crater that must have formed on the original floor is clearly visible through a covering of more recent lava flows.

Peak ring basins are among the high-priority targets for study by BepiColombo once it gets into orbit around Mercury and is able to

deploy its full suite of scientific instruments.

A taste of Mercury science

The snapshots seen during this flyby are among BepiColombo's best so far—taken from the closest distance yet, with Mercury's surface well-lit by the sun. They reveal a surface with clear signs of 4.6 billion years of bombardment by asteroids and comets, hinting at the planet's place in the wider solar system evolution.

It's worth remembering that these images are a bonus: the M-CAMs were not designed to photograph Mercury but the spacecraft itself, especially during the challenging period just after launch. They provide black-and-white 1024x1024 pixel snapshots. BepiColombo's main science camera is shielded during the journey to Mercury, but it is expected to take much higher-resolution images after arrival in orbit.

In 2027, the main science phase of the mission will begin. The spacecraft's suite of science instruments will reveal the invisible about the solar system's most mysterious planet, to better understand the origin and evolution of a planet close to its host star.

But the work has already begun, with most of the instruments switched on during this flyby, measuring the magnetic, plasma and particle environment around the spacecraft, from locations that will not be accessible when BepiColombo is actually in orbit around Mercury.

BepiColombo comprises two science orbiters that will circle Mercury—ESA's Mercury Planetary Orbiter and the Japan Aerospace Exploration Agency's (JAXA) Mercury Magnetospheric Orbiter. The two are carried together to the mysterious planet by the Mercury Transfer Module. Even though the three parts are currently in 'stacked' cruise configuration, meaning many instruments cannot be fully

operated, they can still get glimpses of science and enable instrument teams to check that their instruments are working well ahead of the main mission.

"BepiColombo is only the third space mission to visit Mercury, making it the least-explored planet in the inner solar system, partly because it is so difficult to get to," says Jack Wright, ESA Research Fellow, Planetary Scientist, and M-CAM imaging team coordinator.

"It is a world of extremes and contradictions, so I dubbed it the 'problem child of the solar system' in the past. The images and science data collected during the flybys offer a tantalizing prelude to BepiColombo's orbital phase, where it will help to solve Mercury's outstanding mysteries."

What's next?

This fourth Mercury flyby has lined BepiColombo up for a fifth and sixth flyby of the planet on 1 December 2024 and 8 January 2025. Each is bringing the spacecraft more in tune with the orbit of Mercury around the sun.

The BepiColombo flight control team will remain extra busy until the end of the sixth flyby, after which they return to normal cruise operations for almost two years, until BepiColombo enters orbit around Mercury in November 2026.

Provided by European Space Agency

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